China's Energy Resources & Supply

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Los Alamos National Laboratory

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Energy & Environmental Analysis

US Department of Energy
Office of Energy Intelligence

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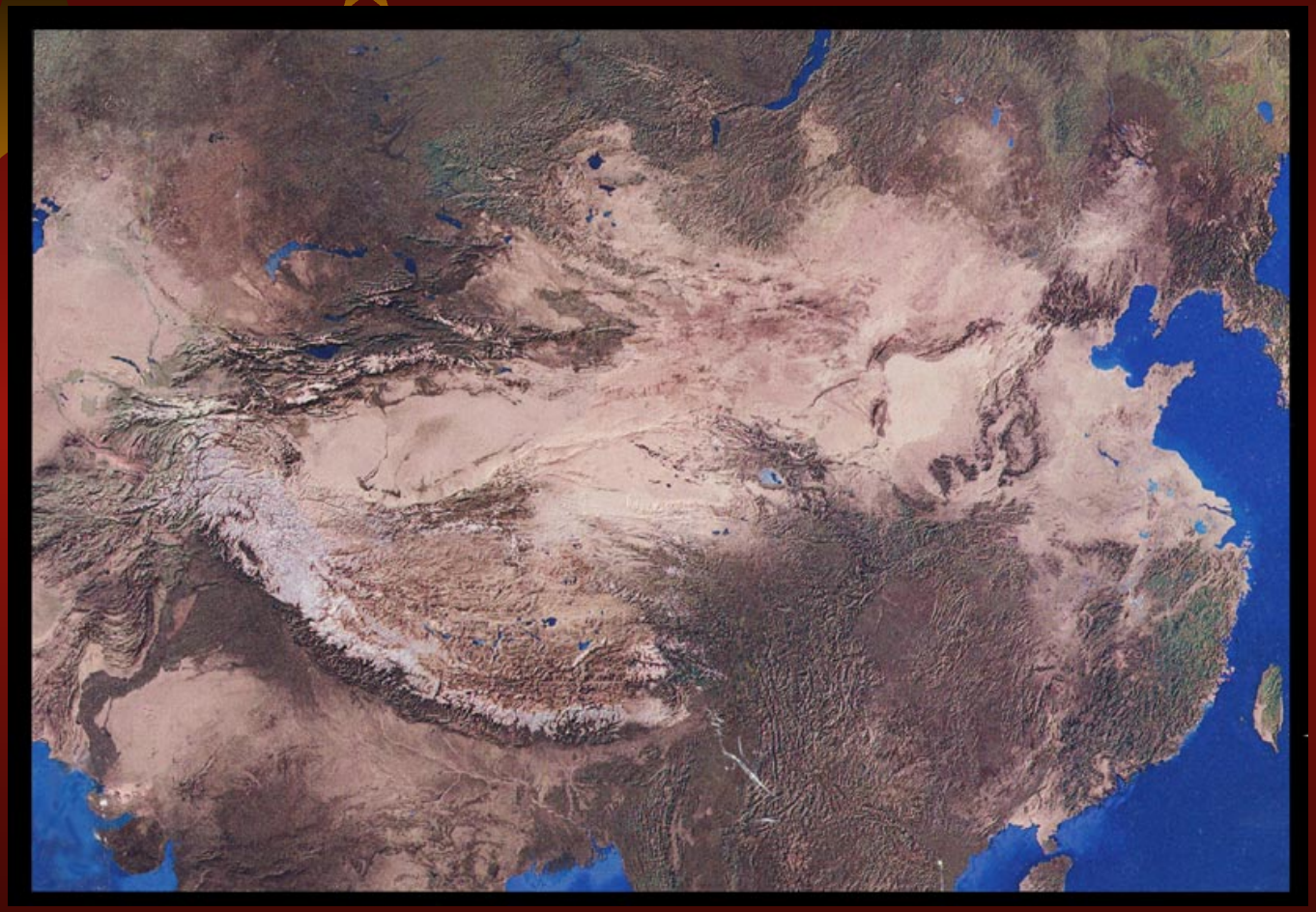
East Asian Geography



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Landsat composite image
courtesy of NOAA

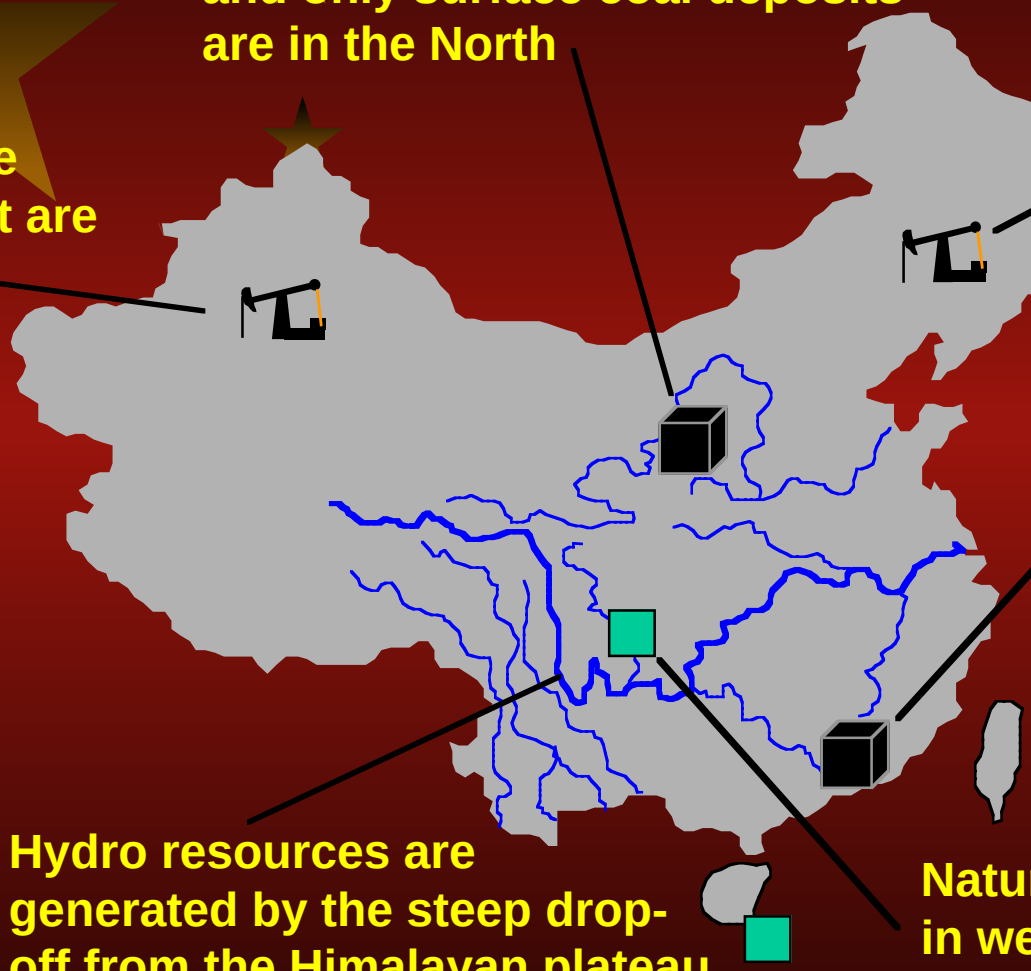
Overview:

- Despite a wealth of raw materials, size and population cause complications
- Easy to consider as “energy poor”
- Consumption is increasing
- Money

Resource Exploitation

- Not extraction or development but distribution
- Consumption centers far from resources
- Distribution infrastructure critical to energy planning

Major Resource Distribution



China's high grade coal and only surface coal deposits are in the North

Production has stagnated in the northeastern oil fields

Oil fields in the western desert are China's only alternate petroleum sources

Most of China's coal production is low grade anthracite from the South

Hydro
Coal
Gas
Oil

Hydro resources are generated by the steep drop-off from the Himalayan plateau

Natural Gas resources are in west-central China, with some new offshore resources

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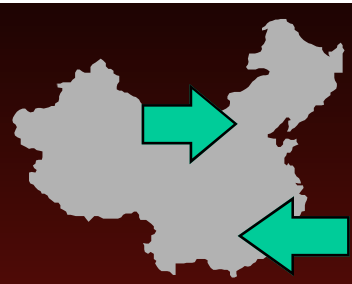
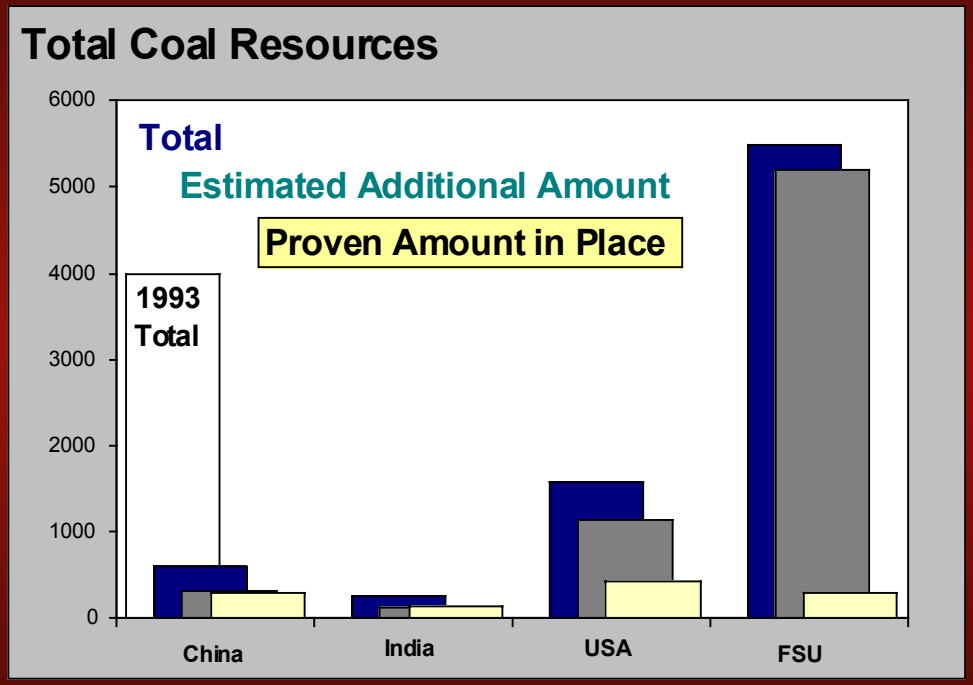
Coal



- 73% of consumption
- 1st in coal production
  - China: 1116 Mt
  - US: 823 Mt
  - FSU: 412 Mt
- Mostly high ash and sulfur content anthracite
- Poor mining conditions
  - Methane explosions
  - Deep, thin seams
  - Minimal surface deposits



Current Production: 1116 Mt
Planned by 2000: 1400 Mt

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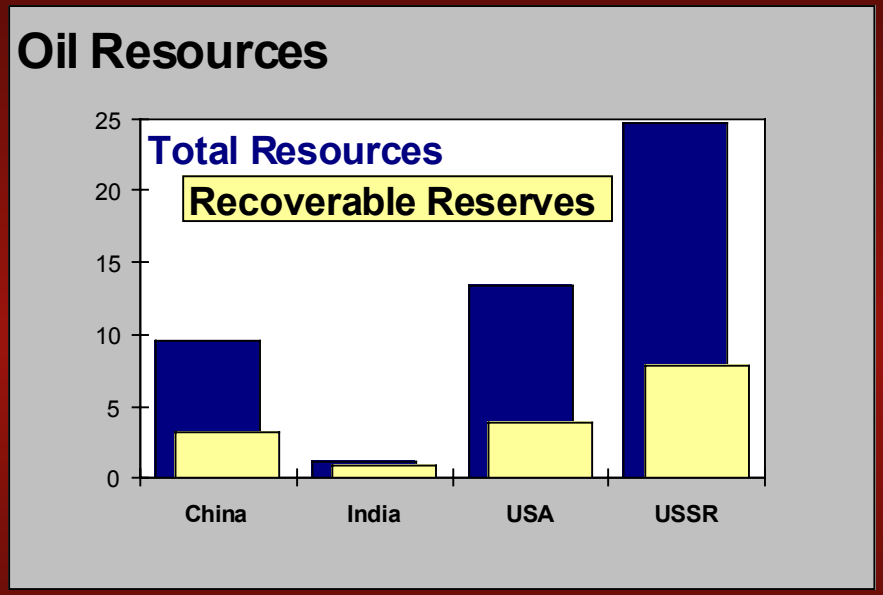
Petroleum

- 60% imported in 1957
- 25% growth through 1970s
- Peaked as exporter in 1985
- Low grade heavy crude
- Small, complex geological structures
- 90% of wells require secondary extraction



- Most production in Northeast
- Traditional fields are failing
- Daqing reserves 50% extracted
- Western desert under development

Tarim Basin Development

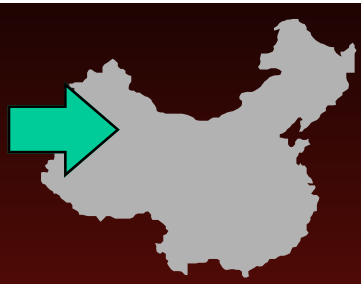


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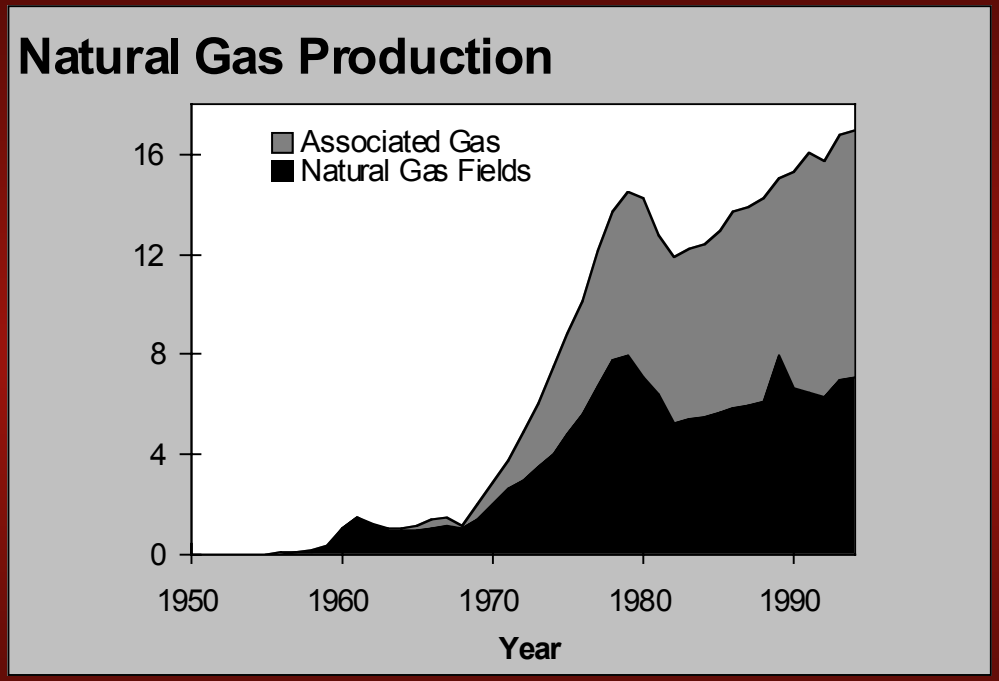
Photo: National Geographic Society

Natural Gas

- Less than 3% of resources proven
- Gas:oil recovery ratio very low
  - China 0.11:1
  - US 1:1
- Minimal development
- Most production in central China
- New offshore production



Current :	15.3 billion m^3
by 2000:	60 billion m^3

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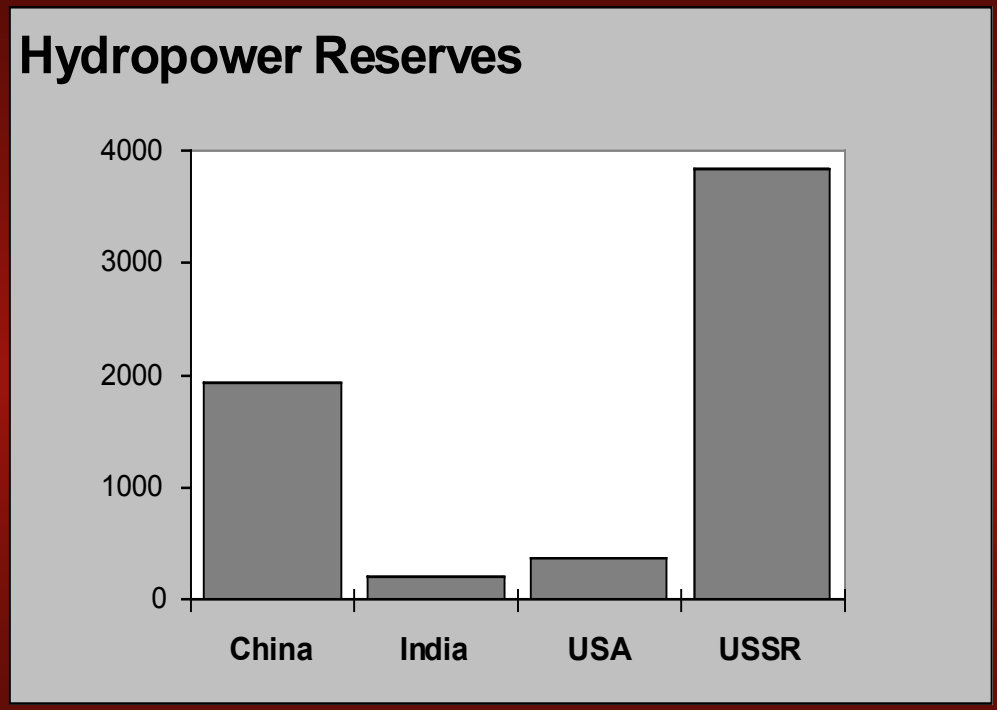
Hydropower

- World's largest hydropower resource
- Remote and mountainous locations
- Sole electricity source in many rural areas



Current Capacity: 183 GW
Planned by 2000: 300 GW

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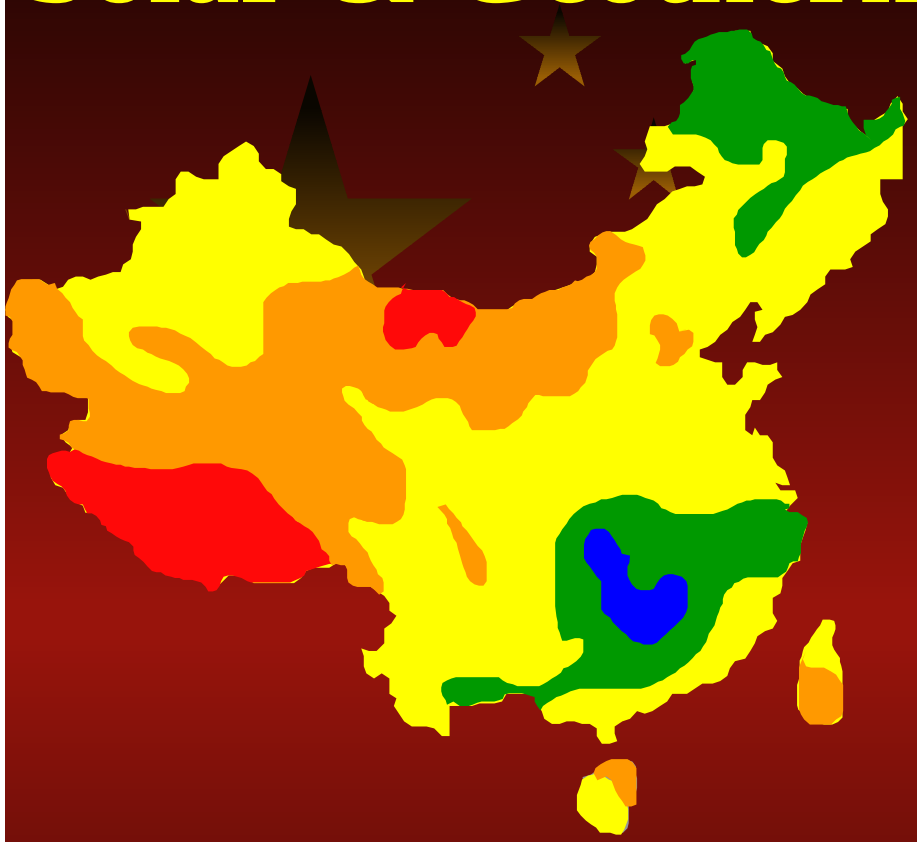
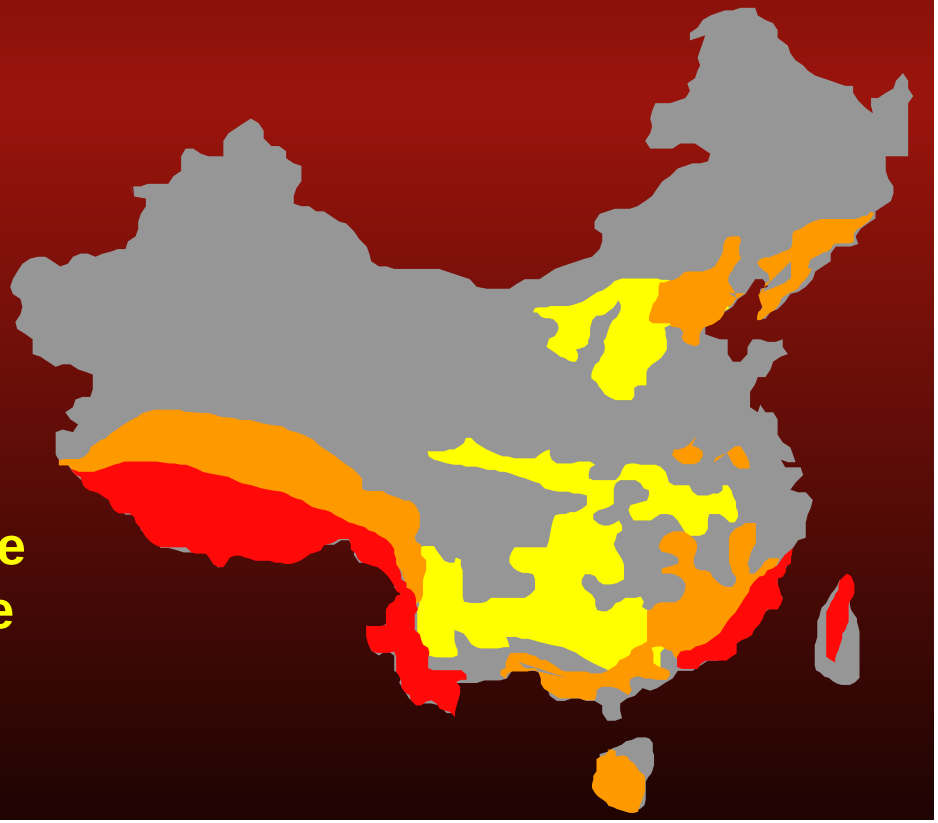
Solar & Geothermal



Solar Energy Distribution

- **Remote Tibetan Plateau has highest solar energy density**
- **Populated central China lowest energy density (cloud covered)**



Geothermal Energy Distribution

- **Regions near Himalayas plateau and Subduction zone of Philippine Plate are geothermally most active**

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Nuclear

- Two online commercial PWRs (2100 MW total capacity)
- More than ten additional proposed reactors
- Purex fuel reprocessing plant under construction
- China has stated goal of increasing nuclear capacity by more than 1000% to 50 GW before 2020.
- Fuel supply questionable

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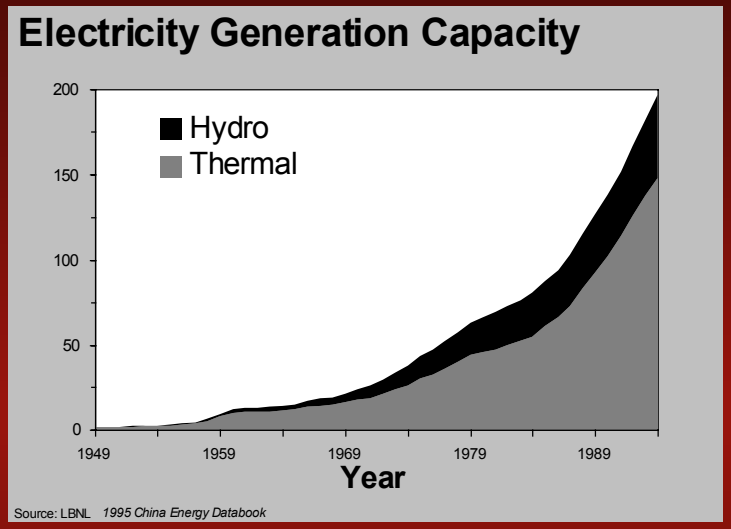
Electricity Generation

- 300 GW by 2000
- 117 GW to 1995 capacity for $100 bn.
- $20 bn in foreign investment



- 74% Thermal
- 26% Hydroelectric
- All others; wind, solar, nuclear, geothermal : <1%

- Infrastructure already strained
- Capacity factors average between 0.6 and 0.7; equivalent to load factors greater than 90%

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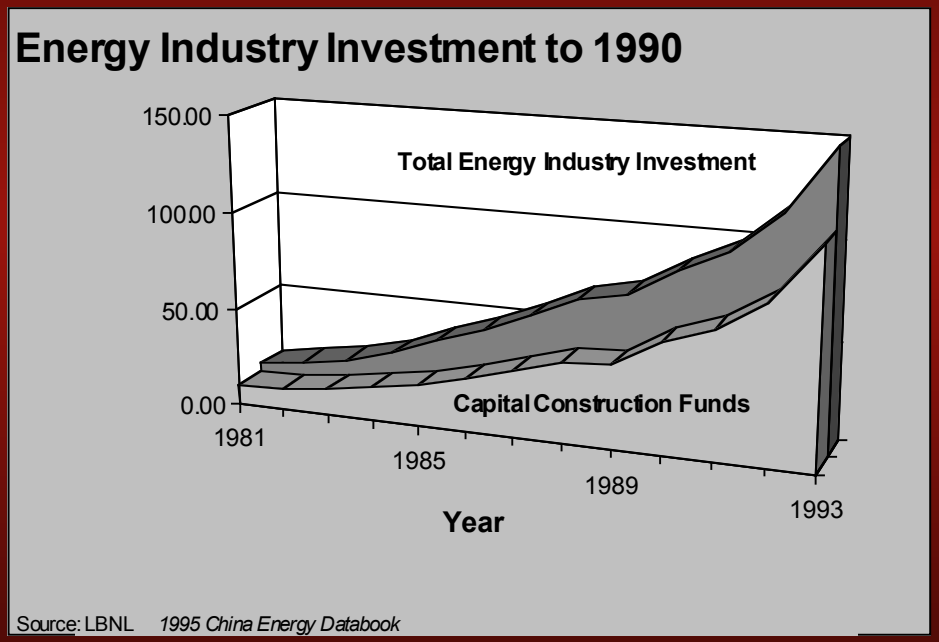
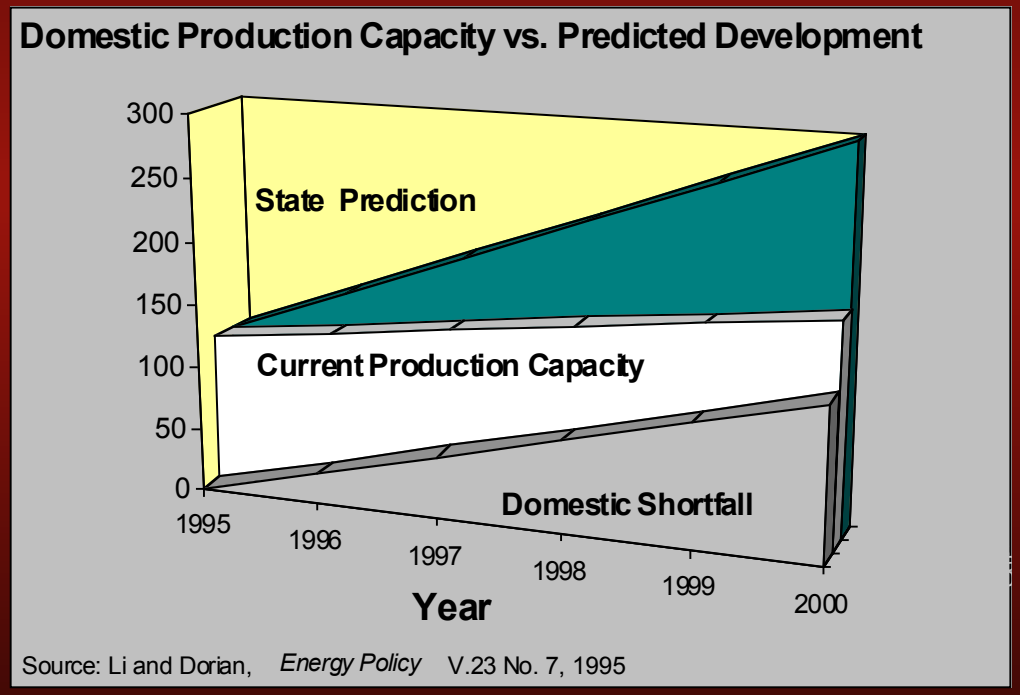
Energy Industry Investment



- 3.9% annual capital investment growth
- •1.7 trillion ($200 bn) invested in fixed assets for 1995 (53% infrastructure)
- •5,100 ($610) per installed kW capacity
- •611 billion ($72 bn) total over five years

Turbine Production

- 300 MW turbines
- Seeking 600MW & 900MW technology
- Cannot domestically manufacture enough to meet demand.
- •732 billion ($86.1 bn) required in foreign supplied generation equipment



Conclusions:

The Chinese petroleum supply is the single most important factor impacting US energy security

- **other resources OK**
- **distribution & infrastructure are problems**
- **electrical power developing**
- **money being spent on infrastructure**
- **foreign assistance required**

There is an opportunity for US commercial involvement in the Chinese energy markets, especially as a source of transferable high technology